Limitations imposed on radio direction-finding systems are discussed in terms of a
generalized representation of such systems in the form of a block diagram. Factors affecting
these limitations include: (1) considerations of signal-to-noise ratio in the early part of the
system, (2) receiver bandwidth requirements for adequate selectivity, (3) width of spectrum
generated by prereceiver encoding and computing processes, (4) restriction to linear processes
in multisignal portions of the system, and (5) availability of operational devices suitable for
use in low-signal-level portions of the system.

A generalized representation of a radio direction-
finding system can be given in the form of a block
diagram or flow chart (fig. 1) showing the operations
or functions which are necessary in translating the
basic measurements on the incident signal field into
the values of the desired incident field parameters.
Limitations are imposed on the system at each stage
in the process. Factors leading to these limitations include: (1) Considerations of signal-to-noise ratio in the early part of the system, (2) receiver bandwidth requirements for adequate selectivity, (3) width of spectrum generated by prereceiver encoding and computing processes, (4) restriction to linear processes in multisignal portions of the system, and (5) availability of operational devices suitable for
use in low-signal-level portions of the system.

The development of the detailed configuration of
direction-finding system is, after all, the performance of a
computational operation. To this point all systems in use are based on some simple-minded analog
computation scheme. This is an unnecessarily
restrictive limitation, especially considering the
tremendous strides which have been made in recent
years in the field of electronic computation.

Two specific direction-finding systems are pro-
posed, both intended primarily for use with antenna
arrays of wide aperture. In one system, intended
principally for circular arrays, a commutating device is used to encode the output of the antenna array in a form suitable for transmission through a single receiver channel. The output of the receiver would
be analyzed, using sampled data techniques, to
obtain the required bearing information. The
second system makes use of a twin-channel receiving
system to avoid the necessity for relatively slow
scanning, thus permitting essentially instantaneous
acquisition of bearing data (by “instantaneous” is
meant a time small enough to permit obtaining a
bearing on the shortest pulse transmittable through
the receiver). The unusual feature of both systems
is the use of an electronic digital computer to perform
the bearing interpolation between planes of symmetry
of the array, and to provide the final numerical
output of the system. The conventional “indicator”
is retained in modified form as an operator aid, and
to permit the operator to “censor” information fed
to the computer, or to “backstop” the computation
system in situations where it would fail.

Note: A more detailed discussion of the material
presented in this paper will be available in printed
form during the first quarter of 1961. It will appear in Interim Engineering Report No. 9, Wullen-
weber Direction-Finding System to be published by the Radio Direction-Finding Research Laboratory,
Department of Electrical Engineering, University of Illinois, Urbana, Illinois, for the Bureau of Ships,
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